Space Weather Technical Forecast

Issued on Friday 17 January 2025 at 01:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with frequent low C-class flares, peaking C4.4 at 16/0726 UTC from AR3964 in the northwest. This region rapidly emerged through this period, and has developed to become magnetically complex, due to the formation of at least one small delta-spot. AR3964 in the northwest is currently classified as Dai/beta-gamma-delta. AR3961 in the southeast is a moderately sized region with moderate magnetic complexity, and currently an Eai/beta-gamma classification, and has increased slightly in area through the period. AR3959 in the northeast is the largest region on the disc, but has a simple magnetic structure, and appears to be gradually declining with the penumbra around the trailing spots decaying. The remaining four regions are all smaller and magnetically simple.

No Earth-bound CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Ongoing fast wind influence was observed. Solar wind speeds were mainly slightly elevated, between 480-500 km/s at first, with brief peaks towards 550km/s. During the second half of the day solar winds speeds declined slightly to generally 420-450 km/s. Density was below average. Interplanetary Magnetic Field, Bt, was Weak, ranging 3-8nT. The north-south component, Bz, was Weak, ranging between +/- 7nT. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was mainly Quiet to Unsettled (Kp 2-3), but with one Active (Kp 4) interval 16/1800-2100 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES-18 was Background. High energy electron flux (greater than 2MeV) at GOES16 was Background to Moderate with the associated 24 hour fluence below the Active threshold. This reached 1.37e7 integrated pfu at 17/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of isolated M-class flares. There is a slight chance of an X-class flare.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Ongoing coronal hole influence is expected to persist throughout the period, predominantly from CH09/-. Slightly elevated to elevated solar winds are expected, perhaps peaking today or tomorrow (17-18 Jan).

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Quiet to Unsettled (Kp 2-3) geomagnetic activity is expected with isolated Active intervals. There is a chance of reaching a G1/Minor Storm interval (Kp 5), most likely today or tomorrow (17-18 Jan).

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to remain at background. GOES-16 high-energy electron flux is anticipated to be at predominantly Moderate levels, perhaps temporarily reaching High at times during the peaks of the diurnal cycles. The associated 24 hr fluence is expected to persist below Active (1e8 integrated pfu), but with a gradually increasing trend.

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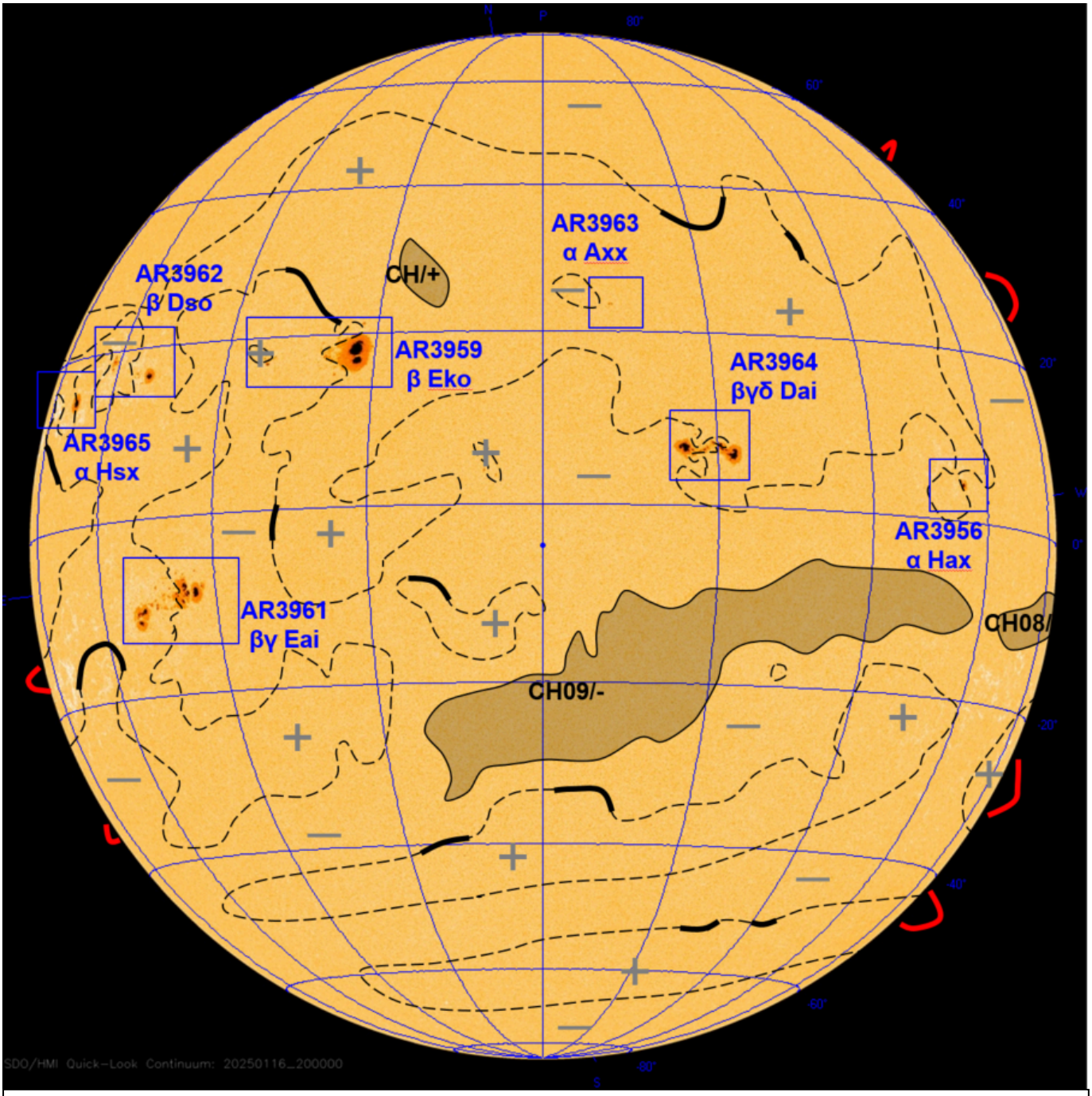
Figure 1: Synoptic Map valid 16/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no Earth-directed CMEs.

The solar wind outlook is dominated by the broad coronal hole across the central southern disc, CH09/-. Connection to this feature is likely to occur today (17 Jan), or may already occurred with a smooth transition from previous CH08/-. Due the longitudinal width of this feature, ongoing fast wind influence is likely throughout the period, with slightly elevated (400-500km/s) solar winds mainly expected, although with a chance of strengthening to become elevated (500-600km/s) at times.

This ongoing enhancement is supported in MOSWOC Enlil output, although this is perhaps over-estimating the longevity of the feature.

Quiet to Unsettled (Kp 2-3) geomagnetic activity is expected with isolated Active intervals. There is a chance of reaching a G1/Minor Storm interval (Kp 5), most likely today or tomorrow (17-18 Jan).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	40	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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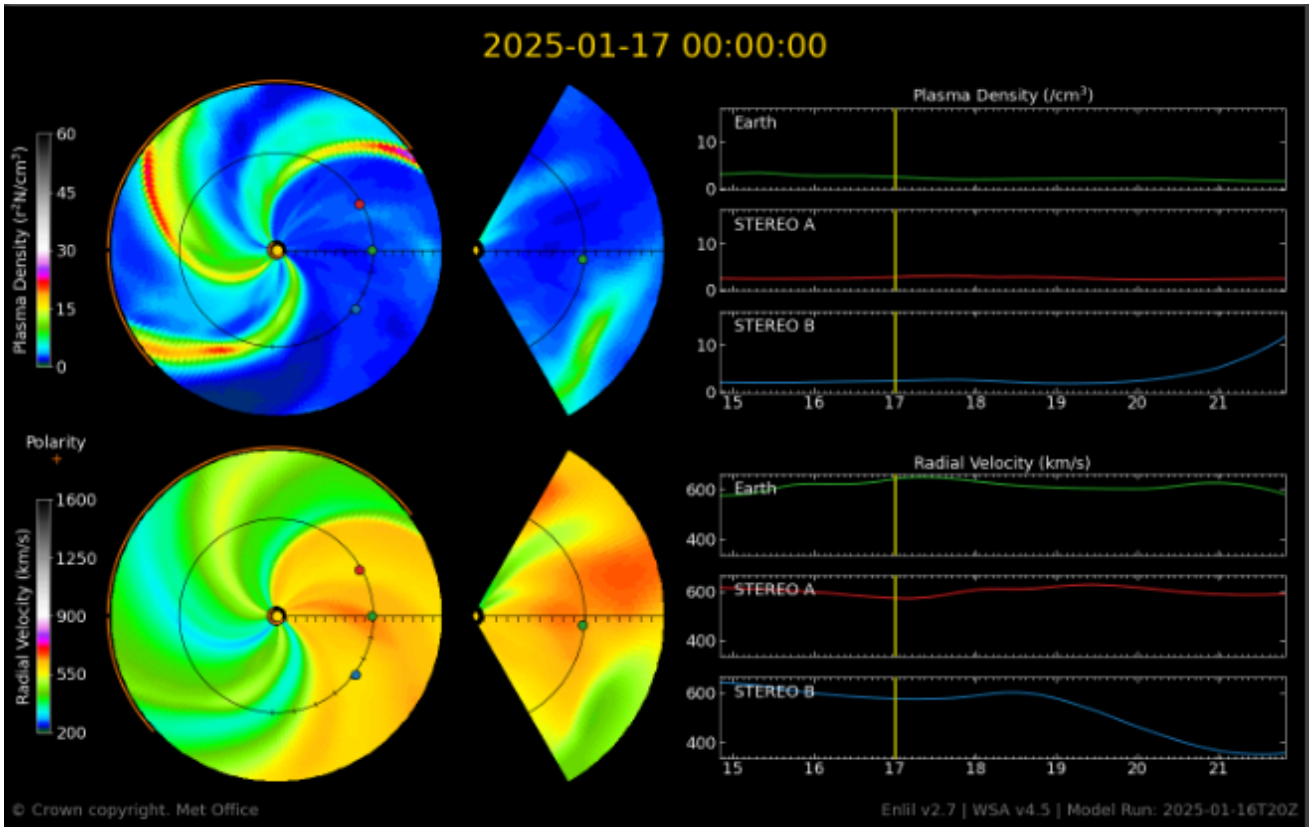
Figure 2: MOSWOC Enlil



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Radio Blackouts - X-Ray Flares

There are seven regions currently on the visible disc. AR3964 in the northwest has continued to increase in spot number, area and length, and remains the most complex region on the visible disc with two small delta spots within the leading spot, the smallest of which has only recently developed. The largest region on the visible disc is AR3959, which remains dominated by the large leader spot, but has a small trailer region to the east, which appears connected in SDO aia-imagery. This trailer region is very small, and it's penumbra has recently decreased, becoming rudimentary. Another region currently of note is AR3961, which has continued to see slow growth through its intermediate region, with some consolidation of the penumbra and spots. A relatively simple bipolar structure has persisted, but a small delta spot within the intermediate portion of AR3961 may be developing. The remaining regions are smaller, stable and magnetically simple.

There remains a chance of isolated M-class flares, mainly from AR3964. There is also a slight chance of an isolated X-class flare.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	10	10	10	10

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Solar Radiation Storms (High Energy Protons)

GOES18 high energy proton flux has remained at background levels over the last 24 hours and is expected to persist at this level. However, AR3964 has recently rapidly developed in the northwest to become a complex region. If AR3964 becomes active, and produces any significant flares, this could potentially lead to proton events being observed at Earth., although currently there is only a slight chance of this occurring.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux observed at GOES16 is currently at moderate levels. Ongoing coronal hole influence is likely to likely to lead to some charging of the Van Allen belts, but potentially result in the majority of this charge persisting below GEO. However, ongoing periods of Moderate flux are likely at diurnal peak, perhaps approaching High at times, most likely later in the period as the fast wind very slowly eases.

Overall, fluence is forecast to remain below Active, but is likely to see a rising trend during the period, which is broadly supported by MOSWOC REFM.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	10	20	30
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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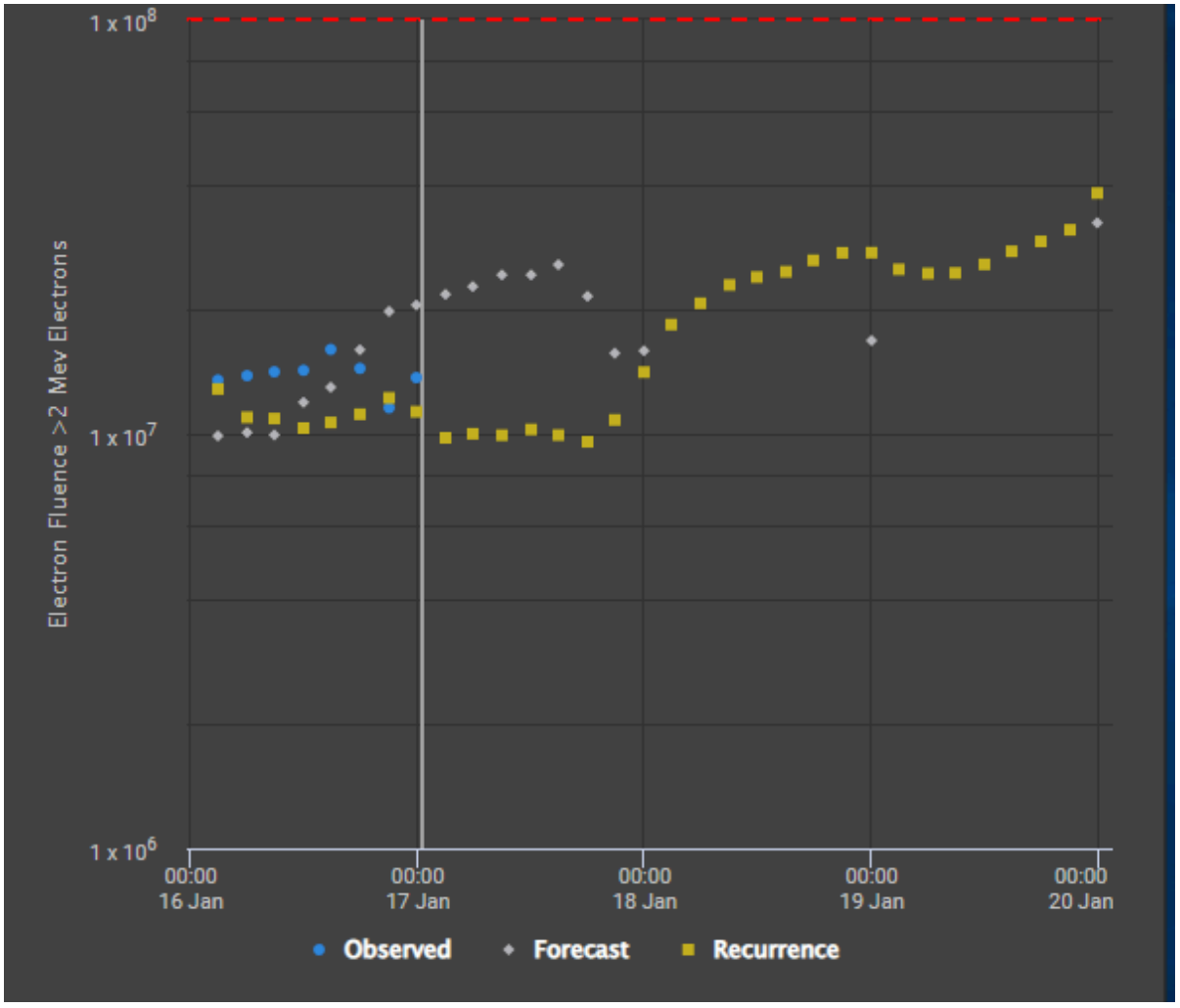
Figure 3: MOSWOC REFM model.



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